

ART. X.—*Hand v. Machine Broken Metal, with regard to their comparative value for the construction and repair of city and suburban streets and roads.* By Mr. A. K. SMITH.

[Read 9th May, 1870.]

After dwelling upon the importance of good and cheap road communication, and referring to the methods adopted by the Romans and other nations of antiquity, he expressed his opinion that no country in the world had done so much in opening up roads as Victoria, where the cost of carriage was reduced thereby to one-twentieth of the maximum price charged in past years. He proceeded to give a series of statistics in reference to Victorian roads, including a statement that during the 18 years ending in 1868, the Government spent £6,331,717 in making roads, and then addressed himself to his main subject. He traced the use of broken stone in road making from the earliest historic times, and, arguing that the Roman system was the best ancient method, pointed to the fact that in the city of Melbourne an improvement had recently been effected by laying channel-pitchers upon a foundation of concrete, instead of sand as formerly, thus re-adopting the old Roman fashion. Turning to English roads, he described the main differences between the various systems in vogue there, as also on the Continent, and showed, by a series of figures prepared by himself, that in the matter of density and weight of stone we were supplied with road material of the best quality in the world. Comparing hand-broken with machine-broken metal (samples of which were exhibited), he went on to give the results of a succession of experiments and observations which he had made during the past few years, and gave their final effect in the fact that a cubic foot of hand-broken metal ($2\frac{1}{2}$ in. gauge) weighed 85lb., while machine-broken metal of the same size weighed no less than 96lb. As a member of the Public Works Committee of the City Council, he had also made many other experiments, the leading points of which he detailed at considerable length, and their results tallied with those which had previously impressed him in favour of the machine-broken metal. He then described the way in which stone-breaking machinery was introduced to Victoria by Mr. Appleton, the original Victorian patentee, and took special occasion to offer his tribute to the memory of the late Enoch Chambers, to whose skill and enterprise the

colony was mainly indebted for the improvements by means of which proper machine-broken metal was made obtainable here. After stating how machine-broken metal had been applied in making and mending Melbourne streets, he stated that its chief superiority lay in the fact that it formed almost immediately a hard, durable road of even surface, and effected an immense saving of traction labour. Moreover, seeing that the leading modern authorities on roads concurred in recommending the use of small metal—of 1 in. gauge, for instance—it was only by mechanical means that the material could be economically and properly produced. Machine metal could be supplied at 7s. per yard, and also gave a good top-dressing for footpaths at 5d. per square yard. He deeply regretted to find so many blind to this patent superiority, that city councillors, when before their constituents, were often made to pledge themselves in favour of hand-broken metal, but he expressed a fervent hope that this feeling would soon give way, and that the degrading drudgery of breaking stones would be spared to the next generation altogether. It was true that professional opinion was to a certain extent divided on the point; but in this respect a rapid change was taking place, and it would assuredly be much accelerated as the greater merits of the machine-broken material became known.

Mr. A. K. Smith concluded his paper by adducing opinions in favour of machine-broken metal. First, those given by various professional and other authorities before the Road Maintenance Committee of the City Council in 1865; then the opinions of Mr. John Reilly and Mr. R. Adams, the past and present city surveyors, who both avowed that they had been converted by experience from the directly contrary convictions which they had previously entertained; and lastly, those expressed by a great number of engineers officially connected with various local governing bodies throughout the country. Finally, he stated a series of propositions, the effect of which was that, by the proper use of stone-breaking machinery, roads might be made at one-half their present cost.

Mr. WILLIAM WALKER referred to several opinions of French engineers against the use of machine-broken metal, and contended that the streets of Melbourne were the worst he had ever seen. For proof of this he pointed to the condition of Elizabeth-street after three days' rain, and said that if that street were subjected to a tropical rain, it would

become impassable. He also denied that the pulverised stone acted as a good binder. As for the degradation of hand stone-breaking, he complained that machinery was driving the poor from the labour market.

Mr. A. K. SMITH desired to observe that he had advanced no general opinion on the excellence of the Melbourne streets. As to the opinion of French engineers, he had quoted several in favour of the system he advocated.

Mr. WILLIAM WALKER reiterated his opinions.

Mr. R. ADAMS (city surveyor) declared that the idea of the pulverised metal being turned into sludge by rain was simply absurd. His opinion had for many years been decidedly against machine-broken metal, and it was derived from observation of several hundreds of thousands of yards of metal broken for railway purposes, but that had now given way to a larger experience of the machine stuff. It had also several other advantages not yet mentioned, such as superior cleanliness, and the rapidity with which a road might be formed thereby.

Mr. BOSISTO had been forced by his municipal duties to pay attention to the subject, and he fully endorsed Mr. Smith's statement, that machine-broken metal would make rapidly a smooth road, which was also cheaper than one of hand-broken metal; but he doubted its durability. This last opinion was derived from experience gathered in Richmond. He still advocated the use of machine-broken metal for light traffic.

Mr. W. CROOKE argued that the want of a good foundation had proved most disastrous to many roads.

Mr. CHRISTIE admitted the cheapness of machine metal, but denied that it had the proper cubical form, by which alone it could be made to bind.

Mr. A. K. SMITH urged that even hand-broken metal was not perfectly cubical. He pointed to specimens lying on the table to show how perfectly solid machine-broken metal would bind, and reminded his hearers that experience of roads of machine metal extended over no more than four years.